Ken's Notes:
- "formed in the base material of a bucket" probably means "same alloy as the bucket"
- "and one" probably means "and integral with", ie: integrally-cast
- "hand of cut" probably means "direction of rotation"
- "parietal bone" probably means "turbine case"
- parvus = small (medical term)

[JP,08-303204,A] Moving blade sealing structure for gas turbine

Inventor: NISHIMURA KEIJI;

Assignee: ISHIKAWAJIMA HARIMA HEAVY IND CO LTD

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Abstract:

PURPOSE:
To suppress thermal stress so as to reduce vibration of a moving blade by arranging a shroud part forming a ring concentric with a rotary shaft and a fin part, which is brought into tight contact with an adjacent moving blade so as to form a ring-shaped hollow disk plate, in each moving blade.

CONSTITUTION:
A honeycomb member 8 is stuck on the inside face of a casing 7. Each moving blade 10 is provided with a shroud part 12 and a fin part 14. The shroud part 12 is arranged in the vicinity of a tip part of the moving blade 10 and is brought into tight contact with the shroud part 12 in the adjacent moving blade 10 mutually so as to form a ring concentric with a rotary shaft. On the axial both side faces of the fin part 14, cutting blades 16, 17 cutting the honeycomb member 8 are formed. The cutting blades 16, 17 are constructed of front faces 16a, 17a making obtuse angles to the rotational direction for the moving blade and side faces 16b, 17b making acute angles to the front faces 16a, 17a and possessing clearance angles to the rotational direction for the moving blade. In this way, less thermal stress is generated in exposure to high temperature combustion gas, so that vibration of the moving blade is reduced.

Family: None

Other Abstract Info: DERABS G97-049457 DERG97-049457

CLAIMS

[Claim(s)]

[Claim 1] It is the seal structure for reducing the quantity of gas flow which flows the clearance with casing

surrounding the bucket nose of cam of a gas turbine, and this. The honeycomb material which becomes a casing internal surface of parietal bone from a thin metallic foil is stuck. each bucket The shroud section which is prepared near [the] a point, sticks mutually and forms the ring of a rotation axis and this core, It has the fin section which sticks with the bucket which prepares and adjoins the method of the outside of radial of this shroud section, and forms a ring-like hollow disk. the radial rim of the fin section Bucket seal structure of the gas turbine characterized by what it is formed so that it may cut deeply slightly to the aforementioned honeycomb material, and the cutting blade which cuts honeycomb material is formed in the shaft-orientations both-sides side of the fin section for.

[Claim 2] The aforementioned cutting blade is the bucket seal structure of the gas turbine according to claim 1 characterized by what is formed in the base material of a bucket, and one.

[Claim 3] The aforementioned cutting blade is nothing and bucket seal structure of a gas turbine according to claim 1 characterized by what is consisted of the side face in which it has angle of relief to the hand of cut of a bucket about the front face which makes an obtuse angle to the hand of cut of a bucket, a front face, and an acute angle.

[Claim 4] The front face of the aforementioned cutting blade is the bucket seal structure of the gas turbine according to claim 1 characterized by what consists of a concave surface prepared in the front face of a hand of cut.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention relates to the point seal structure of the turbine bucket for jet engines still in detail with respect to the bucket seal structure of a gas turbine.

[0002]
[Description of the Prior Art]
Drawing 4 is a typical block diagram of a turbojet engine, and is equipped with an air-intake 1, the compressor 2, the combustor 3, the gas turbine 4, the afterburner 5, the jet nozzle 6, etc. A propellant is burned within a combustor 3. in such a turbojet engine, air is introduced from an air-intake 1, this air is compressed with a compressor 2, a gas turbine 4 is driven by the combustion gas which was made to generate hot combustion gas and occurred, a compressor 2 is driven with this gas turbine 4, and a propellant is again burned by the exhaust gas which came out of the turbine with the afterburner 5, and a hot combustion gas is expanded by the jet nozzle 6, it blows off back, and a thrust is generated. This configuration is the same also at jet engines other than a turbojet engine.
[0003] In such a jet engine, an opening is between the bucket nose of cam of a gas turbine 4, and the internal surface of parietal bone of the casing 7 of an engine (henceforth a bucket clearance), and there is a problem to which a part of combustion gas flows, pressure loss increases this bucket clearance, and a turbine performance falls. In order to reduce flowing of such a bucket clearance conventionally, the blade thickness of ** airfoil point which prepares the shroud of the shape of a ring which separated few openings from the casing internal surface of parietal bone at the nose of cam of ** bucket, and lowers the pressure loss of a wing tip is made thin. ** which an airfoil nose of cam is made to wear out easily at the time of a wing-tip contact, and makes a bucket clearance the minimum -- reverse -- the wing-tip section -- hard -- carrying out -- a casing side -- grinding -- an easy material is covered and the bucket clearance at the time of a contact is made into the minimum by shaving off a casing internal surface of parietal bone at the time of a contact -- the means of a grade was used

[0004]
[Problem(s) to be Solved by the Invention]
However, since the bucket of a gas turbine is **ed by hot combustion gas, if a shroud is prepared like ** If high thermal stress occurs in a shroud, it is easy to become the shortage of an intensity and an airfoil nose of cam is worn like ** If it becomes impossible to take balance by imbalanced attrition, it is easy to

cause bucket vibration and a casing internal surface of parietal bone is shaved off like ** When a bucket carried out thermal expansion to especially shaft orientations, there was a trouble of a grade where the contact resistance of casing and a bucket becomes excessive, and there was a possibility of damaging a bucket in being excessive.
[0005] moreover, since there is a trouble on the function in which a coating layer may lack a part of bucket on stream by the impact at the time of cutting a honeycomb deeply etc. at the system with a means (un-opening [Japanese Patent Application No. 189727 / six to] to the public) to form a cutting layer by the plasma spraying etc., and it is necessary to remove coating before a plasma etching further, or to mask, a cost starts in process and the process of coating itself is unstable -- etc. -- there was a trouble
[0006] this invention is originated in order to solve such a trouble. That is, even if it receives the impact at the time of the contact resistance of casing and a bucket being small, and cutting a honeycomb deeply, even if the purpose of this invention has the low thermal stress generated even if hot combustion gas **s, there is little fear of bucket vibration and a bucket carries out thermal expansion to shaft orientations etc., stable use can be carried out for a long time, and a manipulation process is still simple and it s in a manipulation cost offering the low bucket seal structure of a gas turbine.

[0007]
[Means for Solving the Problem]
It is the seal structure for reducing the quantity of gas flow which flows the clearance with casing surrounding the bucket nose of cam of a gas turbine, and this according to this invention. The honeycomb material which becomes a casing internal surface of parietal bone from a thin metallic foil is stuck. each bucket The shroud section which is prepared near [the] a point, sticks mutually and forms the ring of a rotation axis and this core, It has the fin section which sticks with the bucket which prepares and adjoins the method of the outside of radial of this shroud section, and forms a ring-like hollow disk. the radial rim of the fin section It is formed so that it may cut deeply slightly to the aforementioned honeycomb material, and the bucket seal structure of the gas turbine characterized by what the cutting blade which cuts honeycomb material is formed in the shaft-orientations both-sides side of the fin section for is offered.
[0008] According to the desirable example of this invention, the aforementioned cutting blade is formed in the base material of a bucket, and one. Moreover, the aforementioned cutting blade consists the front face which makes an obtuse angle to the hand of cut of a bucket, a front face, and an acute angle of nothing and the side face in which it has angle of relief to the hand of cut of a bucket. Furthermore, as for the front face of the aforementioned cutting blade, what consists of a concave surface prepared in the front face of a hand of cut is desirable.

[0009]
[Function]
Since according to the configuration of the above-mentioned this invention a bucket has the shroud section and the fin section, forms the ring of a rotation axis and this core by the shroud section and forms the hollow disk of the shape of a ring prolonged in the way outside the ring by the fin section radial To it, it can cut deeply slightly to the honeycomb material by which the rim of the fin section was stuck on the casing internal surface of parietal bone, and can rotate, most openings (bucket clearance) between a bucket nose of cam and a casing internal surface of parietal bone can be lost, and the capacity which flows a bucket clearance can be reduced sharply.
[0010] Moreover, to each bucket, the shroud section can hold down low the separate thermal stress generated among the shroud section, even if a bucket is **ed by hot combustion gas, since it is prepared. Furthermore, since the honeycomb material which consists of a thin metallic foil can be deeply cut comparatively by the parvus cutting force, even if it contacts the fin section, honeycomb material is cut and the fin section hardly wears out. For this reason, bucket vibration hardly breaks out that it is hard to produce imbalance in a bucket. Moreover, since the cutting blade which cuts honeycomb material is formed in the shaft-orientations both-sides side of the fin section even if a bucket carries out thermal expansion to shaft orientations, honeycomb material can be cut by low resistance with this cutting blade, and there is almost no fear of a crash of a bucket.
[0011] Furthermore, if a cutting blade is formed in the base material of a bucket, and one, since can raise the abrasion resistance and shock resistance of a cutting blade, it can be stably used for a long time even if it receives the impact at the time of cutting a honeycomb deeply etc., and a coating layer will remove

and work and masking will become unnecessary, a manipulation process can be simple and can lower a manipulation cost. Moreover, if the front face which makes a cutting blade for an obtuse angle to the hand of cut of a bucket, a front face, and an acute angle are constituted from nothing and the side face in which it has angle of relief to the hand of cut of a bucket, the recess path of cutting waste can be prepared and cutting ability can be raised. Furthermore, if constituted from a concave surface in which the front face of a cutting blade was established in the front face of a hand of cut, a sharp cutting blade can be formed by slight manipulation using a part of base material configuration of a bucket, and cutting ability and endurance can be raised, and a manipulation cost can be lowered further.

[0012]
[Example]
Hereafter, the desirable example of this invention is explained with reference to a drawing. In addition, it is used by giving the same sign to the fraction which is common in each drawing. Drawing 1 is a perspective diagram of the gas turbine bucket equipped with the seal structure by this invention, and a view view and the drawing 3 are the partial enlarged view. [in the A-A line of drawing 1 in drawing 2] It is used for the seal structure of this invention reducing the quantity of gas flow which flows the clearance with the casing 7 surrounding the nose of cam of a bucket 10, and this.
[0013] In drawing 1 , the honeycomb material 8 is stuck on the internal surface of parietal bone of casing 7 by low attachment etc. The honeycomb material 8 is constituted to the plate which has a swage-block-like hole (for example, hole of a hexagonal method) combining thin metallic foils, such as a heat-resistant high metal, for example, a nickel alloy, and an aluminium alloy. As for the radial thickness of the honeycomb material 8, it is desirable that it is larger than the amount of radial thermal expansion of a bucket 10 enough, for example, it is good to be referred to as about about 8mm. Such honeycomb material can prevent gas flowing of the shaft orientations of an engine with the wall of the metallic foil prolonged in radial. Moreover, since it consists of an about 10-30-micrometer thin metallic foil, for example, it can cut deeply by the parvus cutting force comparatively, and even if it contacts the fin section of the bucket mentioned later, the honeycomb material 8 is cut and attrition of the fin section can be prevented.
[0014] Each bucket 10 (the one to shoot is shown in drawing 1) has the shroud section 12 and the fin section 14. Moreover, the dovetail section 11 is formed in the base edge, this dovetail section 11 is planted in a turbine disc 9, and it can really rotate now focusing on the rotation axis of an engine. The shroud section 12 is formed near the point of a bucket 10, is mutually stuck with the shroud section (not shown) of the adjoining bucket, and forms the ring of a rotation axis and this core. Since the shroud section 12 is separately formed for every bucket, even if a bucket is ""ed by hot combustion gas by such configuration, the thermal stress generated among the shroud section can be stopped low.
[0015] The fin section 14 forms the hollow disk of the shape of a ring which sticks with the fin section (not shown) of the bucket which prepares and adjoins the method of the outside of radial of the shroud section 12, and is prolonged in radial. Moreover, the radial rim of the fin section 14 is formed circularly [the rotation axis of an engine, and this core] so that it may cut deeply slightly to the honeycomb material 8. As for this slitting depth, it is good that it is about about 2-3mm.
[0016] Most openings (bucket clearance) between a bucket nose of cam and a casing internal surface of parietal bone can be conjointly lost with rotating, while the rim of the fin section cuts deeply to honeycomb material, since the fin section 14 (hatching of the oblique line shows) of the adjoining bucket sticks and the parvus hollow disk of an opening is formed by such configuration, as shown in drawing 2 , and the capacity which flows a bucket clearance can be reduced sharply. Furthermore, since the honeycomb material 8 which consists of a thin metallic foil can be deeply cut comparatively by the parvus cutting force, even if it contacts the fin section 14, the honeycomb material 8 is cut and the fin section 14 is hardly worn out. For this reason, bucket vibration hardly breaks out that it is hard to produce imbalance in a bucket.
[0017] Drawing 3 is an enlarged view of the fin section 14 of a drawing 2 top. As shown in this drawing, the cutting blades 16 and 17 which cut honeycomb material are formed in the shaft-orientations both-sides side of the fin section 14. In the drawing 2 and the drawing 3 , a bucket 10 is rotated leftward drawing, therefore the both-sides side (a top and inferior surface of tongue) of the fin section 14 is rotated, grinding with honeycomb material. For this reason, when there are no cutting blades 16 and 17, there is an inclination that the frictional resistance of the vertical side of the fin section 14 and honeycomb material becomes large. However, even if a bucket carries out thermal expansion to shaft orientations

with these cutting blades 16 and 17 by forming the cutting blades 16 and 17 as mentioned above, honeycomb material can be cut by low resistance and fear of a crash of a bucket can be abolished.
[0018] As shown in drawing 3 , the cutting blades 16 and 17 consist the front faces 16a and 17a which make an obtuse angle to the hand of cut (the arrow head shows to drawing) of a bucket, a front face, and an acute angle of nothing and the side faces 16b and 17b in which it has angle of relief to the hand of cut of a bucket. This angle of relief has good about 5-15 degrees. By such configuration, the recess path of cutting waste can be prepared and cutting ability can be raised.
[0019] Moreover, the cutting blades 16 and 17 of this invention are formed in the base material of a bucket 10, and one. Since coating on the front face of a bucket etc. can raise the abrasion resistance and shock resistance of a cutting blade, and it can be stably used for the impact at the time of cutting a honeycomb deeply etc. for a long time, and a coating layer removes and work and masking become unnecessary by this configuration, a manipulation process can be simple and can lower a manipulation cost.
[0020] Furthermore, as shown in drawing 3 , the concave surface 19 is formed in the front face of a hand of cut of a bucket 10 at the fraction of the cutting blade 17, and front 17a of the cutting blade 17 consists of a part of this concave surface 19. Using a part of base material configuration of a bucket, by processing side face 17b circularly using the milling cutter of a suitable diameter etc., sharp cutting blade 17b can be formed by slight manipulation, and cutting ability and endurance can be raised, and a manipulation cost can be further lowered by such configuration.
[0021] In addition, this invention is applicable also to the lower fin section although the upper fin section was explained in full detail between the two fin sections 14 shown in drawing 2 in the above-mentioned explanation. Moreover, of course, it can change variously in the domain which this invention is not limited to the example mentioned above, and does not deviate from the summary of this invention.

[0022]
[Effect of the Invention] As mentioned above, even if it receives the impact at the time of the contact resistance of casing and a bucket being small, and cutting a honeycomb deeply, even if the bucket seal structure of the gas turbine of this invention has the low thermal stress generated even if hot combustion gas "s, there is little fear of bucket vibration and a bucket carries out thermal expansion to shaft orientations etc., it can be used stably for a long time, and it has the effect which was [be / low / a manipulation process is still simple and / a manipulation cost] excellent.

DESCRIPTION OF DRAWINGS

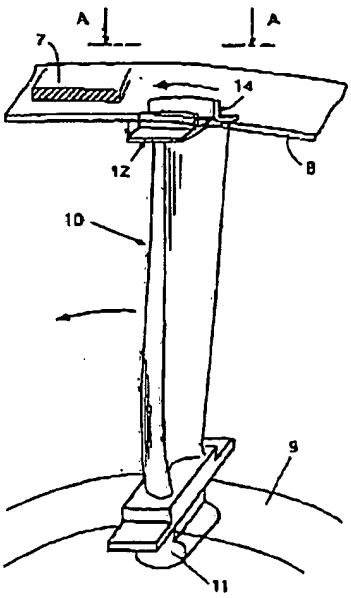
[Brief Description of the Drawings]
[Drawing 1] It is the perspective diagram of the gas turbine bucket equipped with the seal structure by this invention.
[Drawing 2] It is a view view in the A-A line of drawing 1 .
[Drawing 3] It is the partial enlarged view of drawing 2 .
[Drawing 4] It is the typical block diagram of a turbojet engine.

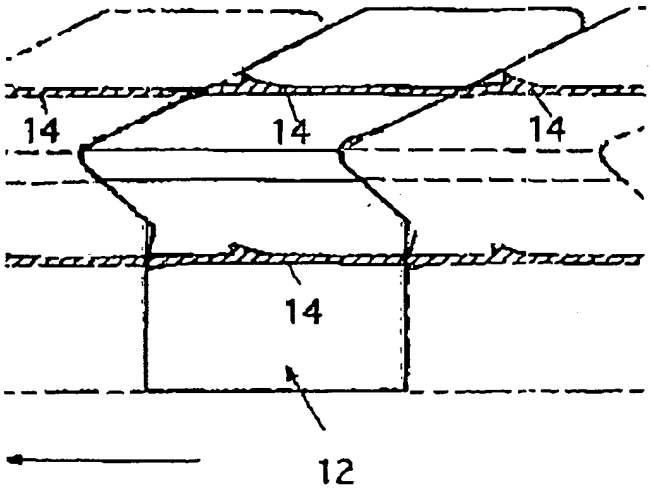
[Description of Notations]
1 Air-intake
2 Compressor
3 Combustor
4 Gas Turbine
5 Afterburner
6 Jet Nozzle
7 Casing
8 Honeycomb Material
9 Turbine Disc
10 Bucket
11 Dovetail Section
12 Shroud Section
14 Fin Section

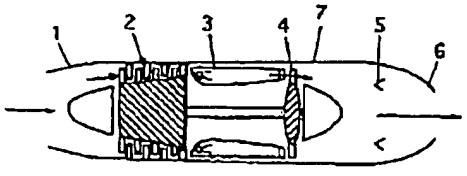
16, 17 Cutting blade
16a, 17a Front face
16b, 17b Side face
19 Concave Surface

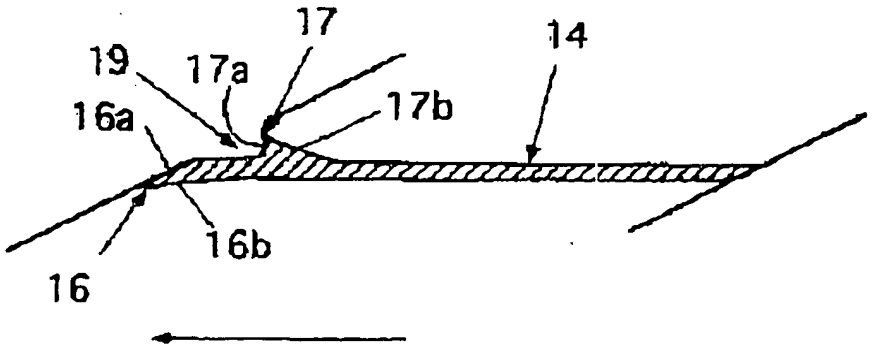
[Translation done.]

Clockwise from Top Left, Drawings 1 thru 4:









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